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RHEINLAND'S MINE HAMBACH IN WEST GERMANY

Val Srajer

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RHEINLAND'S MINE HAMBACH IN WEST GERMANY

by

V.Srajer *

ABSTRACT

The open cast mine Hambach in the Rheinland coal mining district was visited on Monday, October 27, 1986. The Hambach mine development commenced in 1978 - it is newest and largest German mine today. The annual production in 1986 is expected to reach 20 Mt of lignite. When fully developed, the mine will be capable to produce 50 Mt of lignite annually. The world's largest bucket wheel excavators are employed at the mine.

The Hambach mine is expected to replace production from Villa, Frechen and later Fortuna mine, as these operations are phased out.

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* Head, Operation Research, Surface Mining Laboratory, CRL, CANMET, Devon, Alberta.

LA MINE HAMBACH, À RHEINLAND, EN ALLEMAGNE DE L'OUEST

par

V. Srajer*

RÉSUMÉ

L'auteur a visité la mine à ciel ouvert Hambach, dans le district houiller de Rheinland, le lundi 27 octobre 1986. Cette mine, la plus récente et la plus importante de l'Allemagne de l'Ouest, a été mise en service en 1978. En 1986, la production annuelle devrait se chiffrer à 20 000 tonnes de lignite. Lorsqu'elle aura atteint sa pleine capacité, la mine aura une production annuelle de 50 000 tonnes de lignite. On y trouve les plus grands excavateurs à roue-pelle au monde.

La production de cette mine devrait remplacer celle des mines Villa et Frechen et plus tard, celle de la mine Fortune, à mesure que l'on mettra fin à ces opérations.

*Chef, Recherche opérationnelle, Laboratoire d'exploitation en surface, Laboratoires de recherche sur le charbon, CANMET, Devon (Alberta).

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INTRODUCTION

The visit to Rheinlands open cast mine Hambach was arranged by Rheinbraun Consulting GmbH, a wholy owned subsidiary of R.B.W. (Rheinische Braunkohlenwerke Aktiengesellschaft), which is a subsidiary of the Rheinland Westfalia Electric Company (RWE), owned by German government. Rheinbraun Consultants act as an engineering company for Rheinland coal mines and also as consultants to a number of clients in Europe and around the world.

The brown coal deposits of the Federal Republic of Germany amount to 55 Gt of which 35 Gt are considered to be recoverable by open cast mining methods. At present, close to 2.4 Gt of reserves are being opened to mining.

The Hambach open cast mine is the largest and deepest mine in the Rheinland district. It is located approximately 40 km west of Cologne, south of A4 autobahn. The best approach to the mine is to take the Lindenthal exit from Cologne (Aachener Str.) and follow the road No. 55 to Elsdorf. Behind the town the road is located between mine pit and waste dump. The mine office is well visible on the south side of the road. The location of the mine is apparent from Fig. 1 (1).

RHEINLAND MINE DISTRICT

The reserves of lignite (brown coal) of the Rheinland district are considered as being recoverable if the overburden and interburden to coal ratio is less than 10:1 and the deposit is situated outside large towns.

The new coal mines are being opened not to add to the existing coal production, but simply to replace production from already depleted deposits. This was the case of the Fortuna mine replacing production from Zukunft and Inden mines, this is the case now with Hambach mine replacing production from Villa, Frechen and later on from Fortuna mine.

HAMBACH MINE
ENSCHEDE
ARNHEM
NIJMEGEN
Bocholt
MÜNSTER
DORTMUND
BOCHUM
ESSEN
DUISBURG
KREFELD
WUPPERTAL
DÜSSELDORF
MÖNCHENGLADBACH
KÖLN
BONN
AACHEN
Düren
Bergisch Gladbach
Gummersbach
Siegen
Hagen
Lüdenscheid
Recklinghausen
Gladbeck
Dinslaken
Wesel
Goch
Kleve
Emmerich
Zevenaar
Arnhem
Apeldoorn
Deventer
Enschede
Oldenzaal
Rheine
Emsdetten
Borghorst
Coesfeld
Dülmen
Lüdinghausen
Haltern
Dorsten
Wulfen
Castrop-Rauxel
Herne
Bochum
Witten
Hattingen
Velbert
Solingen
Leverkusen
Bergisch Gladbach
Overath
Much
Siegburg
Troisdorf
Bad Godesberg
Bad Honnef
Remagen
Linz
Neuwied
Altenkirchen
Wissen
Betzdorf
Freudenberg
Kreuztal
Olpe
Meschede
Arnsberg
Soest
Unna
Hamm
Ahlen
Warendorf
Rheda
Gütersloh
Bielefeld
Detmold
Paderborn
Lippstadt
Soest
Iserlohn
Werdohl
Plettenberg
Schwelm
Wuppertal
Mönchengladbach
Rheydt
Viersen
Venlo
Roermond
Weert
Maastricht
Heerlen
Eschweiler
Stolberg
Jülich
Eschweiler
Aachen
Hasselt
Tongeren
Liège
Verviers
Malmedy
Prüm
Bitburg
Daun
Mayen
Andernach
Koblenz
Neuwied
Limburg
Wetzlar
Gießen
Marburg
Siegen
Olpe
Hagen
Iserlohn
Lüdenscheid
Plettenberg
Meschede
Brilon
Winterberg
Medebach
Korbach
Frankenberg
Biedenkopf
Dillenburg
Herborn
Wetzlar
Limburg
Bad Ems
Montabaur
Altenkirchen
Hachenburg
Siegen
Olpe
Kreuztal
Freudenberg
Betzdorf
Wissen
Altenkirchen
Hachenburg
Montabaur
Bad Ems
Nassau
Diez
Limburg
Weilburg
Wetzlar
Gießen
Marburg
Biedenkopf
Frankenberg
Korbach
Brilon
Winterberg
Medebach
Meschede
Arnsberg
Soest
Lippstadt
Paderborn
Detmold
Bielefeld
Gütersloh
Rheda
Warendorf
Ahlen
Hamm
Unna
Kamen
Lünen
Dortmund

The new open cast mines are generally characterized by more unfavourable conditions then the previous ones. It means that an essentially higher overburden to coal ratio must be coped with.

The Rheinbraun brown coal district is the biggest undivided brown coal deposit in Europe. Todays activities are taking place west of Cologne and and in the area west of Duren. About 90 % of the coal produced in Germany comes from the Rheinland district.

The continuous mining system, consisting of bucket wheels, conveyors and spreaders, is the only one used at the mines. Limited number of loaders and one dragline at the Fortuna mine are used to remove small pockets of coal below the bottom pit level that are out of reach of bucket wheel excavators.

HAMBACH MINE

Mining System.

The opening up procedure of the Hambach mine was completely new owing to the high overburden/coal ratio. The amount of output for the economical operation was scheduled to be 1 Mm^3/day of both overburden and coal. The continuous mining system proposed for the mine was therefore required to handle amount of material far higher than anytime before. For this reason, two excavators of an output of 240,000 m^3/day and a belt conveyor with steel cord of 2.8 m width and a stacker of 240,000 m^3/day capacity were initially developed. The overburden removal at the mine commenced in 1978. The large 240,000 m^3/day excavators are the modified 200,000 m^3/day bucket wheels previously employed at the Fortuna mine. The number of buckets was increased to 18 and the rotating speed of the wheel was also increased. During the first year of operation, the productivity per man and shift was 120 t of coal.

To enable independent movement of the BWE on one part and the loading point on the other, the excavator portion is separated from the loading portion, and a connecting telescopic belt bridge is used. The upper excavation height is about 51.0 m above crawler level and the maximum possible downward cut is about 17.0 m below the crawler level. The excavation range can be widened by lifting or lowering the excavator above or below the level of loading parts, so that a total excavating height of 97.5 m can be reached. The machine is 225.0 m long. A wheel of 21.6 m in diameter was equipped with 18 buckets holding 6.3 m^3 each. When using a 70.0 m wheel boom, a block 91.0 m wide can be mined. The excavator weights 13,300 t, electric power consumption total 14,000 kW. Four electric motors, each 830 kW, drive the wheel of the machine.

The capacity of the bucket wheel excavator is matched by corresponding capacity at the stackers: their capacity is increased by wider conveyor belts. Three belt stackers with a receiving belt supported on a separate driving unit were chosen to keep the construction weight as low as possible. The new machine is able to stack up to a height of 40.0 m. The depth in downward stacking is influenced by the fact that the discharge material must be built up on the bottom of the spoil banks to solidify the slopes. Assuming a 35^{o} angle of the slope, its resulting height is about 60.0 m. To widen this range, the machine is designed to enable the stacker to be placed up to 20.0 m below the level of the dump site belt. The stacker's unloading range thus totals 116.0 m in height.

All conveyors at the site and trains outside the mine are operated and controlled by only one dispatching desk. Automatic devices control the unmaned driving and transfer stations and stop the installations in case of emergencies.

A total of four bucket wheel excavators and three stackers were installed at the mine. The assembly was carried out at the site near Niederzier, west of Hambach mine. The machine was moved on two crawler-mounted transporters that move the belt drive terminals. The transporters are 11.0 m long, 9.5 m wide, weight 210 t and have a carrying capacity of 700.0 t each. The three transporters for moving the belt return terminals

are 6.5 m long, 6.0 m wide, weight 62 t and have a carrying capacity of 210.0 t. The six drive terminals, each weighting 700.0 t, have four 2000 kW motors and move the 2.0 m wide belts at a speed of 7.5 m/s.

Overburden from the Hambach mine was removed initially to an outside dump and created a hill outside the mine area. It is planned to use the hill as recreational area, for skiing, down hill racing, etc. During the last two years, overburden was also transported to the Fortuna mine for backfill. The material is moved in a specially designed corridor of two 3.0 m wide conveyors.

The average stripping ratio is between 7:1 and 8:1. The mining area extends 60 ha, outside waste dump cover 560 ha base. The mine employ 1280 persons at their operation, 170 persons are in associated operations contracted to outside agencies.

The 1986 area of the Hambach mine is illustrated in Fig.2 (2), typical section through the deposit is in Fig. 3 (2). Fig.4 (2) shows the mining area and Fig. 5 (2) shows the spoil area. The photographs in Figs.6 to 9 illustrate various parts of the mine, such as general views of the mine, mine conveyor system, spoil site and spreaders at the spoil site.

Reclamation.

Lignite mining in the Rheinland district affects a region with a high population density of about 420 persons/km^2 (3). The mined area include intensively used agricultural areas with high quality soils as well as forest and recreational land. Surface mining operations interfere with the natural environment. since it affects large areas of land for a given period of time and brings about a change in landscape.

By the year 1985, a total of 223 km^2 had been affected in the Rheinland by lignite mining since its beginnings. Current mining operations cover 85 km^2, the remaining 138 km^2 has been reclaimed (3). Of this, 61 km^2 have been

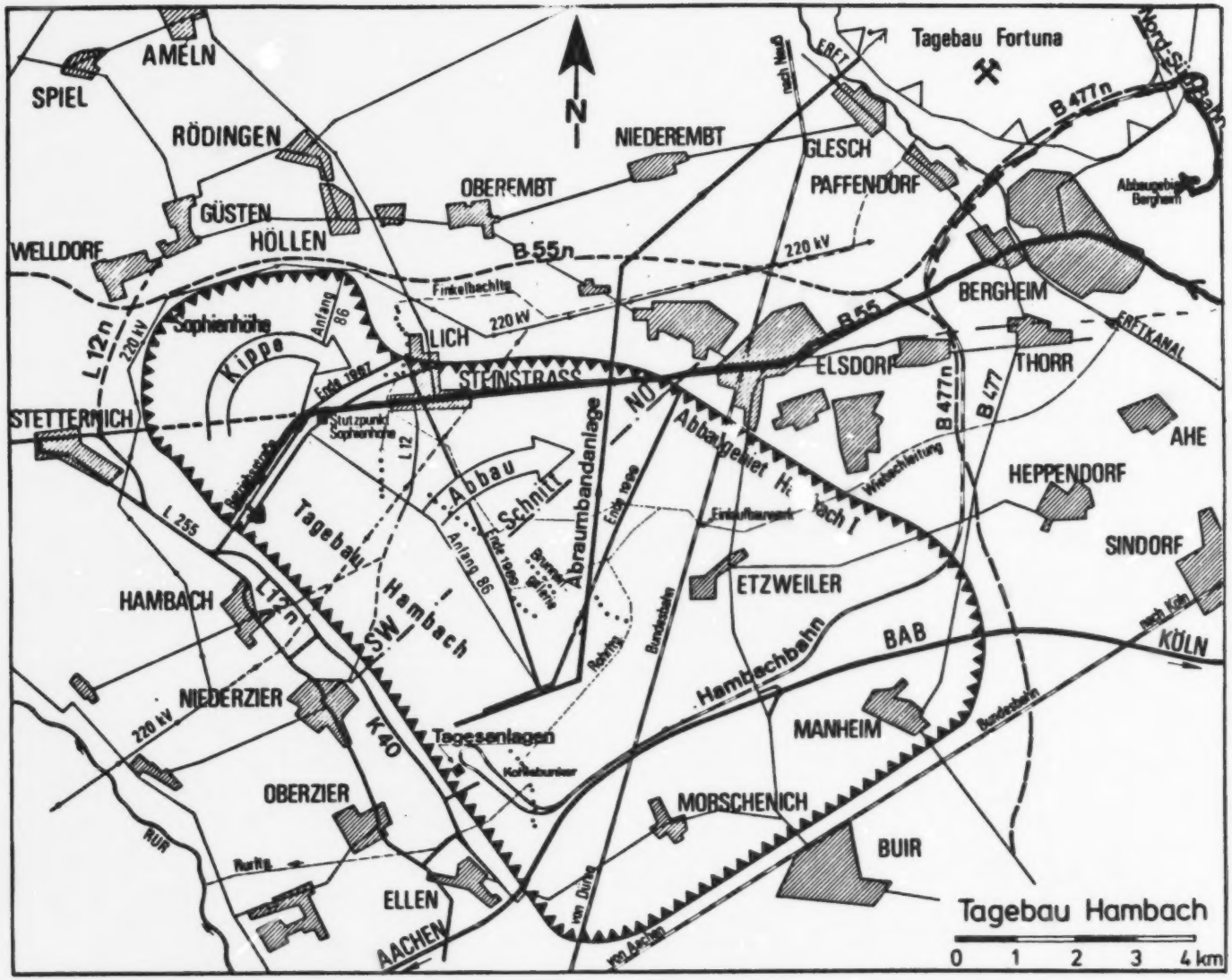

Fig. 2 - Hambach Mine Area

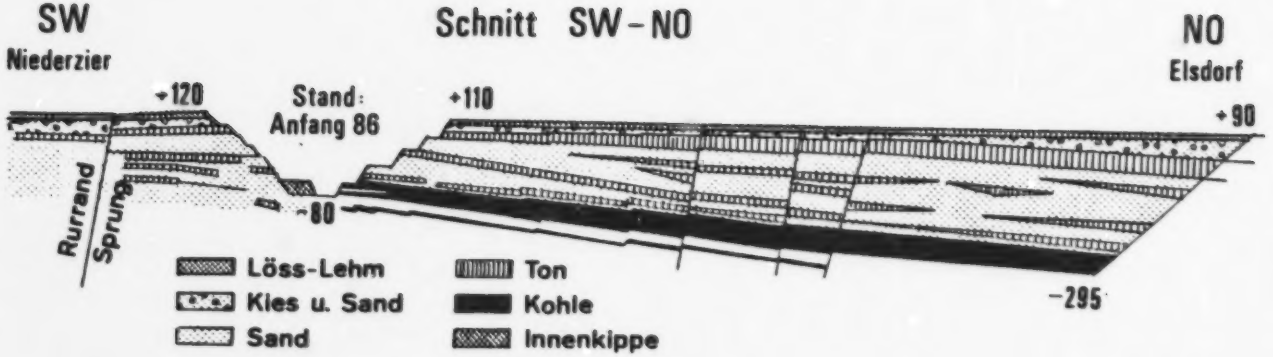

Fig. 3 - Typical Section of the Deposit

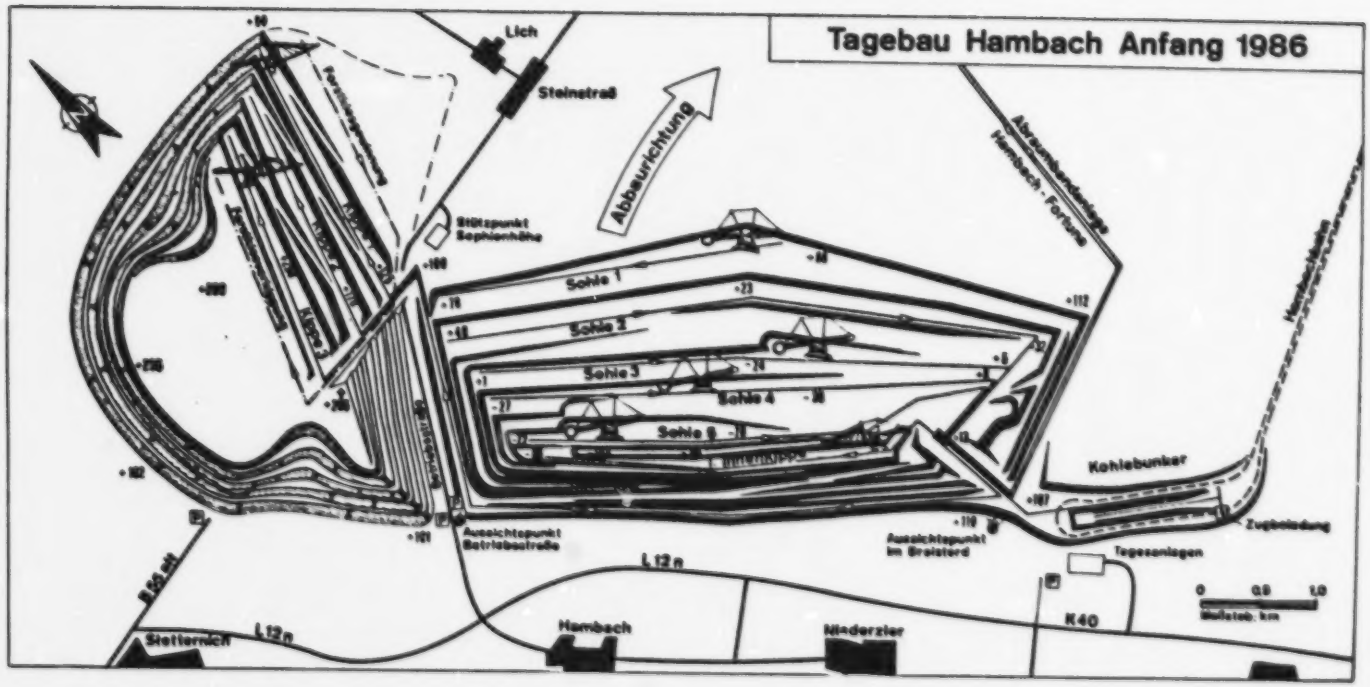

Fig. 4 - Mine Excavation Area

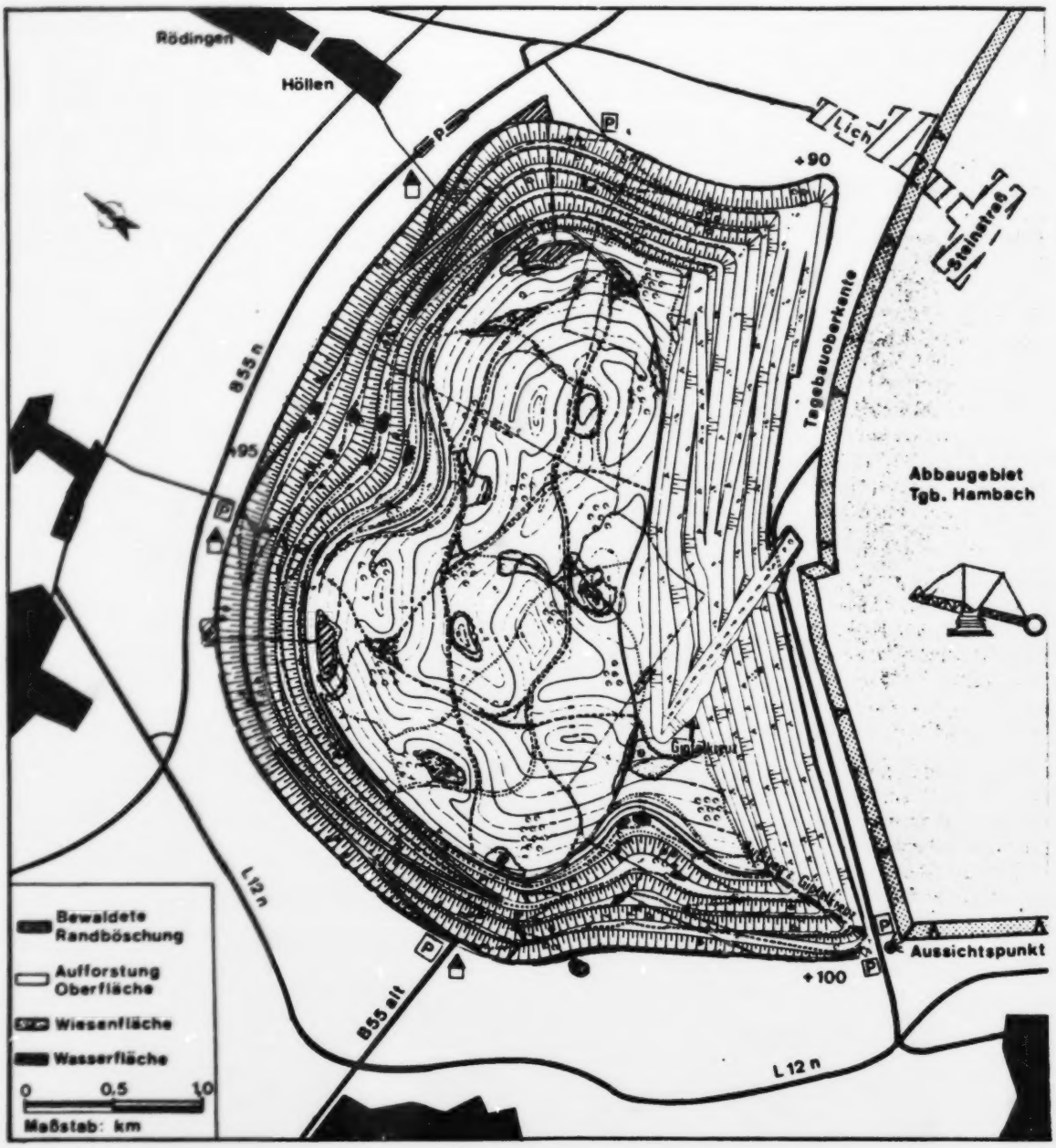

Fig. 5 - Mine Spoil Area

Fig. 6- West Site Benching

Fig. 7- Spreaders at Spoil

Fig. 8- O & K Spreader (240 000 cu.m. day)

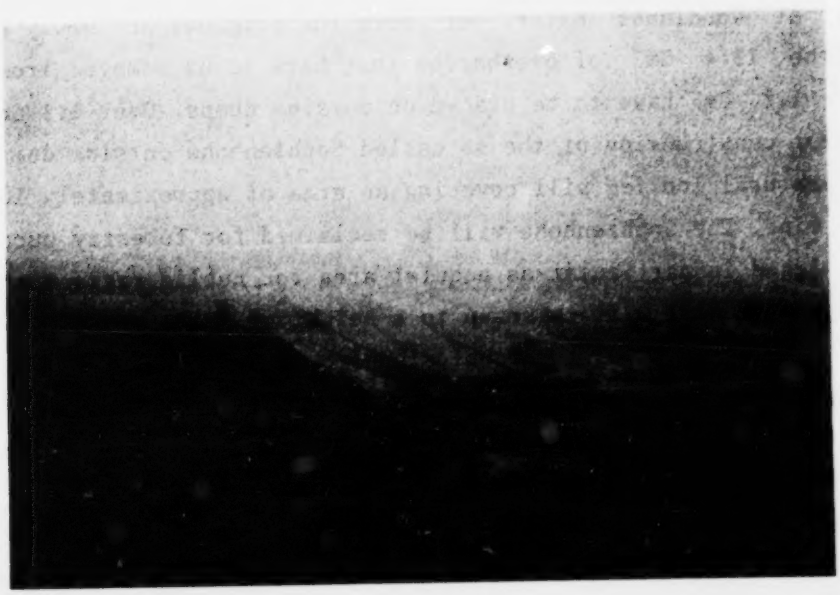

Fig.9 - General View of the Pit

transformed into agricultural areas, 60 km^2 into woodlands, 7 km^2 into lakes, and 10 km^2 into areas used for different purposes (resettlement areas, traffic corridors, etc).

For agricultural reclamation, high quality loess loam is removed selectively and transported by trains to the mined out areas that need reclaiming. As a rule, the stackers operating in the mines spread the material in a dry state to a thickness of 2.0 m onto the top dump layer. The layer underneath is generally made up of permeable sand and gravel in order to allow water circulation and drainage.

The forest areas are reclaimed by using a mixed substrate composed of fine and coarse gravel, sand, and at least 20 % loess loam. This material is removed by the bucket wheel excavators from the uppermost benches in the mines and spread over the unfinished dumps, 3 to 5 m thick. Subsequently, site specific tree and shrub species are directly planted, serving as a basis for growth of an ecologically diversified forest.

In the planning of Hambach mine reclamation, it was stipulated that part of the original Hambach forest be preserved as a basic unit for subsequent reclamation. The mining proceeds in such a way that at any time at least 30 km^2 of woodlands exist, of both the original and newly grown forests. Of the 15.4 Gm^3 of overburden that have to be removed from the Hambach mine, 2.7 Gm^3 have to be placed on outside dumps. Over 1.1 Gm^3 of soil was used for construction of the so called Sophienhohe outside dump, an artificial but natural looking hill covering an area of approximately 10 km^2 north of the mine. The Sophienhohe will be reclaimed for forestry purposes only and is designed in particular as a quiet area for public recreation. In its final form the hill will raise up to a height of 195 m above the surrounding terrain. As a rule, the final slopes have a 1:4 inclination. The benches in between have a standard width of 25 m. In the western and northern parts of the dump, two trough shaped ravines are created where the benches attain a maximum width of 110 m and the final slopes have a 1:10 overall inclination.

A Demag 430 small BWE with a capacity of 1200 m^3/h was used at the dump site to remove material that was expected to be covered by the Sophienhohe hill later. Largely pure loess soil with an average thickness of 2.0 m was removed. A separate conveyor system was installed for selective placing of various types of overburden material and topsoil. A small stacker, with a boom length of 25 m and a conveyor bridge of 57.5 m long, equipped with a hydraulic levelling unit able to negotiate 1:10 inclination, was installed at the top of the hill to spread the material. A 2.0 m thick layer of soil is spread in such a way that the surface undulations do not exceed 0.5 m. There is no subsequent treatment, which results in a nearly uncompacted soil offering to the forest plants an excellent rooting. During the last six years, more than 6 million forest seedlings were planted on the Sophienhohe.

ACKNOWLEDGEMENT

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